Experimental Study on Bridge Strands Galvanized with Zn-Al Alloy

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Summary

The strands consisting of 19 parallel steel wires galvanized with Zn (90%) and Al (10%) alloy are produced and corrosion acceleration tests have been conducted. The anti-corrosion performance is compared with the conventional strands galvanized with Zn. The strands are kept under three different corrosion environments: kept at a relative humidity (RH) of 60%, kept at a RH of 100%, and wrapped with wet gauze which simulates the wet condition. The strands are kept in the thermo-hygrostat at 40oC for 150 days. The mass loss due to corrosion of the strands galvanized with Zn-Al under the relative humidity of 60% and 100% is small and the strands have sufficient corrosion resistance. Under the wet condition, the corroded mass of the strands galvanized with Zn-Al is 15 times larger than that under the relative humidity of 100%. The strands galvanized with Zn-Al have smaller corrosion than those galvanized with Zn under the three environmental conditions. Corroded mass is larger in the surface wire, the inside wire and the centre wire in this order. The cross section of corroded strands is investigated by an optical microscope showing that the corrosion product of Zn is loose and easy to exfoliate from the steel layer. On the contrary, the corrosion product of Zn-Al alloy is dense and hard to exfoliate from the steel layer. This difference is the reason of the superiority of the Zn-Al galvanized wires.

Keywords: bridge cables, steel wires, steel strands, zinc-aluminium alloy, galvanized wires, corrosion, corrosion acceleration tests.

1. Introduction

Cables consist of high strength steel wires, which are almost exclusively galvanized with zinc to improve corrosion resistance. However, galvanized wires seem to be insufficient to prevent corrosion because corrosion problems have occurred in actual bridges [1]. A new technology has been developed for high strength bridge wires to further increase corrosion resistance: steel wires are galvanized with zinc (Zn) and aluminium (Al).

Nakamura et al. carried out experimental studies using Zn-Al galvanized wires and found below [2]. The mass loss of steel wires due to corrosion under the relative humidity of 60% and 100% is much smaller than that under the wet environment, and the amount of corrosion is not much different between Zn-Al galvanized wires and Zn galvanized wires. On the other hand, the mass loss of the steel wires galvanized with Zn-Al is distinctively smaller than those galvanized with Zn under the wet condition. A bridge cable consists of parallel wire strands or helical wire strands consisting of many steel wires. Therefore, a further study is required to prove if the above findings with individual wires by can be applied to strands consisting of many wires.

In this study the strands consisting of 19 parallel steel wires galvanized with Zn (90%) and Al (10%) alloy are produced and corrosion acceleration tests have been conducted under three different

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